STATE OF MICHIGAN
DEPARTMENT OF ENVIRONMENTAL QUALITY
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

STEVEN E. CHESTER
DIRECTOR

May 3, 2007

Mr. Ben Baker
Senior Environmental Project Leader
Michigan Operations
The Dow Chemical Company
1790 Building Washington Street
Midland, Michigan 48674

Dear Mr. Baker:

SUBJECT: *GeoMorph*™ Pilot Site Characterization Report, Upper Tittabawassee River and Floodplain Soils (Report); The Dow Chemical Company, Michigan Operations (Dow); MID 000 724 724

On June 12, 2006, the Michigan Department of Environmental Quality (MDEQ), Waste and Hazardous Materials Division (WHMD), approved the Upper Tittabawassee River *GeoMorph*™ Sampling and Analysis Plan (UTR SAP) and Quality Assurance Project Plan, *GeoMorph*™ Investigation Tittabawassee River (QAPP), as a pilot methodology to characterize sediments and floodplain soils in the upper Tittabawassee River (*GeoMorph*™ reaches A-O), subject to a number of exclusions and limitations. In particular, the UTR SAP was approved on a "pilot" basis with the understanding that the "pilot" status would be removed when Dow and Ann Arbor Technical Services, Inc. (ATS), provided sufficient information to demonstrate that, for the Tittabawassee River corrective action investigation activities, the *GeoMorph*™ process would provide a site characterization work product that is substantially equivalent or superior to a site characterization developed using conventional techniques.

The MDEQ has determined that the pilot phase of the *GeoMorph*™ based investigation has been successful and that the *GeoMorph*™ process, subject to the limitations and clarifications identified below, is approved for use to complete the site characterization for the balance of the Tittabawassee River study area and the upper portion of the Saginaw River.

This determination is based on the review of the *GeoMorph*™ Report that was submitted to the MDEQ on February 1, 2007, two key supporting technical memorandums that were submitted on March 30th and 31st, 2007, and information provided to the MDEQ during the series of biweekly meetings that have been held since February 1, 2007. Additional information is being provided to the MDEQ as data analysis continues, including the development of cross-sections for each major transect (presented in draft form on April 26, 2007), statistical analysis of the sample populations from the individual geomorphic surfaces pursuant to Section 5.4.2.1 of the UTR SAP, and the development of a detailed sampling and analysis plan for the in-channel deposits of the UTR.

On February 14, 2007, after initial review of the February 1, 2007, Report, the MDEQ identified four key components that required additional clarification or development prior to removing the "pilot" status from the *GeoMorph*™ process. These four components and their associated resolution/clarification follow:

1. **Adequacy for Site Characterization.**

   Dow/ATS was required to provide information, beyond that information that was provided in the February 1, 2007, Report, to demonstrate that the level of site characterization provided by the *GeoMorph*™ process is substantively equivalent to conventional methods of site characterization, given the very large size of the study area.

   Resolution/Clarification: To resolve this issue, at the request of the MDEQ, Dow/ATS has provided additional maps and cross-sections to the MDEQ for review. To date, the statistical analysis referred to in Section 5.4.2.1 of the UTR SAP has not been completed or submitted. However, a review of the data collected using fixed-interval transects in comparison to data collected using the *GeoMorph*™ process indicates that the *GeoMorph*™ process provides a comparable level of information and, in some cases, appears to do a better job of predicting areas with similar concentration ranges.

   The MDEQ continues to reserve the right to require additional sampling, as necessary, to refine the understanding of the distribution of contamination in and between the identified depositional units (geomorphic surfaces). As with conventional site investigation techniques, the need to conduct additional sampling will be based, in a large part, on reasonable predictions of future land use and the level of certainty required for remedial decision-making.

2. **Method Comparability Study – Chlorinated Dioxins and Furans by Method 1613 B and 1613 – TRP/RT, Tittabawassee River & Upper Saginaw River (Comparability Study), Michigan, posted to e-Project on March 31, 2007.**

   The use of the "rapid turn" dioxin and furan analytical methodology is a key component of the *GeoMorph*™ investigation process for the study area and required detailed review prior to approval for use in the balance of the investigation area.

   In general, the MDEQ has determined the 1613 – TRP/RT methodology is acceptable for continued use in the project area and has performed well over the broad range of dioxin and furan concentrations encountered in the project area. As discussed with Dow/ATS, the 1613 – TRP/RT methodology does not provide direct information on the presence of all of the dioxin and furan congeners that are analyzed by Method 1613 B. The data from the Comparability Study indicates that this can result in the underestimation of toxic equivalence (TEQ) concentrations below 1000 parts per trillion TEQ. In particular, 1,2,3,7,8-PeCDD appears to be an important congener in the evaluation of contaminated fish from the Tittabawassee and Saginaw Rivers. As a result, the MDEQ requested that Dow add the 1,2,3,7,8-PeCDD congener to the "rapid turn" analysis. Dow/ATS indicated that it was not possible to add the 1,2,3,7,8-PeCDD congener to the 1613 – TRP/RT methodology and maintain the efficiency of the "rapid turn" methodology.

   Resolution/Clarification: Dow/ATS proposed, and the MDEQ has agreed, that the *GeoMorph*™ data management process will be modified to include automatic confirmation analysis using Method 1613 B with second column confirmation under those conditions where congener patterns are unusual and/or when the 2,3,7,8-TCDD congener contributes more than 10 percent of the TEQ estimated by Method 1613 – TRP/RT analysis (ETEQ). In addition, actively eroding soils and in-channel sediments will be analyzed by Method 1613 B with second column confirmation. The frequency of these additional analyses will be agreed upon during the development of the Middle

Tittabawassee River Sampling and Analysis Plan (MTR SAP). The MDEQ continues to reserve the ability to require Dow to provide confirmation of any ETEQ result(s) by Method 1613 B with second column confirmation.

3. **Distribution of Polychlorinated Dibenzo-p-Dioxin/Dibenzofurans on Fractionated Soils from the Tittabawassee River Floodplain (Geochemistry Study), posted to e-Project on March 30, 2007.**

   The first phase of the Geochemistry Study is a key component of the *GeoMorph*™ investigation process for the study area and required detailed review prior to removing the "pilot" status from the *GeoMorph*™ process. As discussed during the working meeting on April 12, 2007, additional work in this area will continue to be necessary to refine our understanding of the fate and transport of key contaminants in the project area.

   Resolution/Clarification: A second phase of geochemistry work will be planned and implemented as part of the development and implementation of the MTR SAP. This work, and any associated analysis and reporting, will be scheduled for completion by the end of August 2007 so that the results can be utilized for the balance of the 2007 field work. Note that this will include analysis of additional samples from the UTR study area. This work will include, but is not limited to, the determination of other contaminants of concern that may be associated with the graphitic carbon particles and different soil/sediment soil particle size fractions, determination of the density and other important physical characteristics of the graphitic carbon particles, organic carbon content, and additional work on the distribution of dioxins and furans in representative in-channel sediment samples.

4. **Process for the Implementation of Interim Response Activities (IRAs)/Pilot Corrective Action Plans (PCAPs) during the Remedial Investigation Process.**

   During the implementation of the UTR SAP, it became apparent that the MDEQ and Dow needed to define a clear process to evaluate the need for IRAs and, where necessary, an appropriate trigger for the implementation of IRAs in advance of the implementation of a final remedy.

   Resolution/Clarification: The attached IRA/PCAP Implementation Decision Tree (IRA/PCAP Decision Tree) has been collaboratively developed over the past several months to address this issue. The IRA/PCAP Decision Tree will be incorporated into the MTR SAP and will be a component of Appendix K of the Remedial Investigation Work Plan for the Tittabawassee River and Upper Saginaw River and Floodplain Soils (RIWP) that was submitted on December 1, 2006.

   Trigger levels have been identified to initiate the IRA/PCAP evaluation process. To be clear, these trigger levels are only for the prioritization and implementation of IRAs to reduce exposure in the short term. These trigger levels are not to be interpreted as cleanup criteria that would be applicable to a final remedy.

   These trigger levels are consistent with our discussions to strike a balance between (1) the implementation of the IRAs to reduce risk in the near term and (2) moving forward with the implementation of the overall remedial investigation. The trigger levels for delineation of a potential intervention area are applicable to soils up to one foot in

depth (or within one foot of the face of an eroding surface) and to in-channel sediments regardless of depth.

In addition to the four key components identified above, several other clarifications and limitations have been identified and discussed with Dow/ATS with respect to the approval of the *GeoMorph*™ process for implementation in the balance of the study area:

- At this time, the MDEQ is specifically not approving the "surface weighted average concentration (SWAC)" approach described in the UTR SAP. The MDEQ is willing to consider this approach once the technical basis and limitations of the SWAC approach have been described in detail. The MDEQ and ATS, on behalf of Dow, have begun technical discussions on the proposed SWAC approach, and it is anticipated that agreement will be reached on the SWAC approach during the development of the MTR SAP.

- Based on the results of the UTR investigation, it has been determined that a detailed in-channel chemical characterization of the Tittabawassee River is necessary. It is our understanding, based on the results of our working meeting on April 26, 2007, that the detailed in-channel SAP for the UTR will be submitted to the MDEQ for review and approval by May 15, 2007. In-channel characterization work for the MTR will be addressed during the development of the MTR SAP.

- On March 29, 2007, the MDEQ and Dow/ATS agreed on samples that would be analyzed for the extended list of constituents of concern (as identified in Attachment G of the December 1, 2006 RIWP). The agreed-upon list of these samples was summarized in an e-mail from Mr. Phil Simon of ATS on April 11, 2007. It is our understanding that these samples are currently under analysis and that the results will be available in time to help direct the development of the MTR SAP (May, 2007). MTR samples for extended analysis will be identified during the implementation of the MTR SAP.

- Additional erosion scar sampling is necessary for the UTR. This work will be completed as part of the IRA/PCAP activities for the UTR. Erosion scar sampling for the MTR will be addressed during the development and implementation of the MTR SAP.

- As discussed during the working meeting on April 26, 2007, the process for the delivery of draft data and maps for MDEQ analysis needs to be streamlined. During this meeting, the MDEQ and Dow agreed that a process that provides a three- dimensional rendering of the data would be ideal, and this process will be pursued over the course of the 2007 field season. In the interim, the MDEQ and Dow agreed that working drafts of maps, cross-sections, and analytical results would be provided monthly during the 2007 field season. The specific requirements for the draft submittals will be identified in the MTR SAP. Final data from the implementation of the *GeoMorph*™ SAP(s) will continue to be provided in accordance with the conditions of Dow's hazardous waste management facility operating license.

- With respect to the production of isochem maps of dioxin and furan concentrations for the UTR, the MDEQ and Dow have agreed that until the three-dimensional data management and viewing system becomes available, Dow will provide maps with posted maximum TEQ concentrations and surface TEQ concentrations. In addition, Dow will provide transect cross-sections annotated with depth-specific TEQ concentrations and other contaminant concentration information to help describe the spatial relationships of the contamination in the study area.

As agreed to during the working meeting on April 26, 2007, ATS will provide the finalized cross-sections for the remainder of the UTR major transects by June 1, 2007.

To conclude, the MDEQ believes that the "pilot" phase of this project has been successful and looks forward to working with Dow and ATS to complete the remaining UTR and MTR work during the 2007 field season. I have instructed my staff to continue their frequent meetings with Dow and ATS in order to facilitate the development of the MTR SAP on a schedule that meets the needs of the upcoming field season. We believe that it is necessary to complete the development and approval of the MTR SAP by early June in order to meet this goal.

Should you have questions regarding this approval, please contact Mr. Allan Taylor, Hazardous Waste Section, WHMD, at 517-335-4799 or by e-mail at taylorab@michigan.gov; or you may contact me.

Sincerely,

George W. Bruchmann, Chief
Waste and Hazardous Materials Division
517-373-9523

Enclosure

cc: Mr. Greg Cochran, Dow
Mr. David Gustafson, Dow
Mr. Peter Simon, ATS
Mr. Philip Simon, ATS
Mr. Joseph Heimbuch, de maximis, inc.
Mr. Gerald Phillips, U.S. Environmental Protection Agency, Region 5
Mr. Greg Rudloff, U.S. Environmental Protection Agency, Region 5
Mr. John Steketee, U.S. Environmental Protection Agency, Region 5
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Ms. Cheryl Howe, MDEQ
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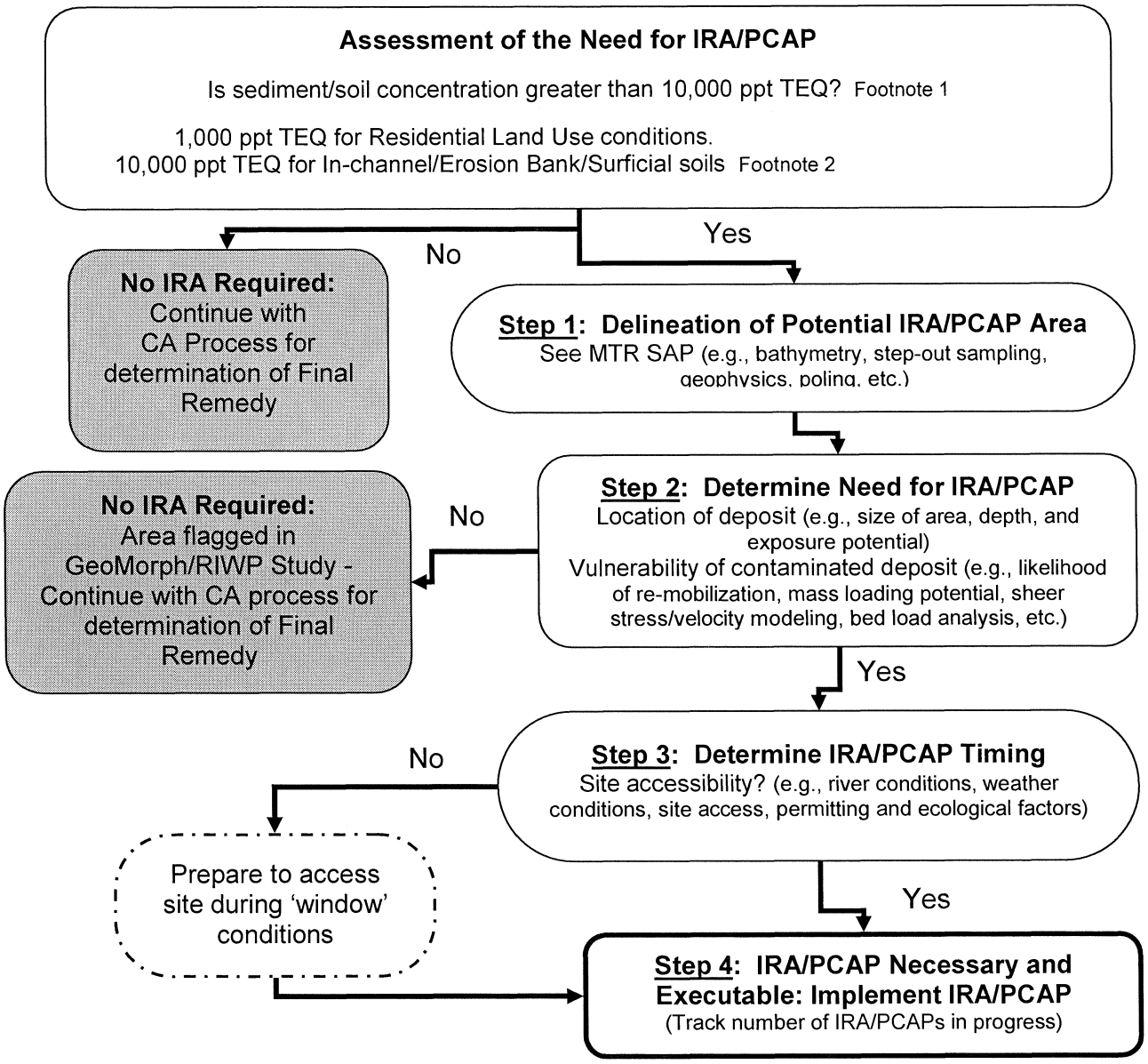
Mr. Arthur Ostaszewski, MDEQ
Mr. Allan Taylor, MDEQ
Off-Site Corrective Action File

IRA/PCAP Implementation Decision Tree

4/30/07

Objective: To define a process that consistently addresses future sampling results for determining when the IRA/PCAP response needs to be judiciously initiated. Any identified IRA/PCAP work is performed to reduce human exposure for the short term and is separate from the ongoing requirement to complete the Corrective Action (CA) process for selecting, designing and implementing the final corrective measures/remedial action plan which will address long term human health and ecological issues (which may incorporate IRA/PCAP work into the final CA measure).



Footnote 1: This decision tree currently applies only to Dioxins and Furans. This IRA/PCAP decision process will need to be reviewed and revised based on continued RIWP findings (e.g., other PCOIs, other factors affecting IRA/PCAP process).

Footnote 2: Evaluation of 'surficial soils' is to include intervals up to and including one foot in depth. For eroding bank samples, interval is within one foot of bank surface.